Claims

[c1] A retro-reflective etalon (R-etalon) comprising:

an etalon filter;

two polarization rotators;

two linear polarizers; and

an end mirror reflector;

the components arranged in the sequence: the first linear polarizer, the first polarization rotator, the etalon filter, the second polarization rotator, the second linear polarizer, the end mirror reflector;

the end mirror reflector arranged in substantial or perfect parallel to the etalon filter;

the first polarization rotator to rotate the polarization of the light reflected from the etalon and to let the reflected light to be absorbed by the first polarizer;

the second polarization rotator to rotate the polarization of the light reflected from the etalon and to let it to be absorbed by the second polarizer.

[c2] The R-etalon of claim 1 wherein the etalon is an air-spaced etalon defined by a first partial reflector and a second partial reflector, said reflectors mounted in a parallel spaced-apart relationship to form a gap in between.

[c3] The R-etalon of claim 1 wherein the etalon is defined by a first

partial reflector and a second partial reflector, said reflectors formed on the two parallel surfaces of a piece of transparent material and is dispersion compensated.

[c4] The etalon of claim 3 wherein the thickness or the refractive index or both of the transparent material can be changed thermally or by applying an electrical field.

[c5] The R-etalon of claim 1 wherein the two polarization rotators are Faraday rotators.

[c6] The polarization rotator of claim 5 wherein the Faraday rotator can rotate the polarization 45degree.

[c7] The R-etalon of claim 1 wherein the two polarization rotators are quarter waveplate.

[c8] The two polarization rotators of claim 7 wherein the fast optical axes of the one quarter waveplate is aligned in parallel to the fast optical axis or slow optical axis of another quarter waveplate.

[c9] The two polarization rotators of claim 7 wherein the optical axis of the two waveplates are aligned 45degree against the polarization of the incident light.

[c10] The R-etalon of claim 1 wherein the linear polarizer only lets light with the polarization in parallel to its polarization axis to pass through substantially.

[c11] A frequency tunable laser cavity comprising:
an extended gain chip generating substantially polarized light;
a R-etalon;
wherein, because of the light from the gain chip is substantially linearly polarized, the first polarizer in the R-etalon is not a must.

[c12] The laser cavity of the claim 11 wherein the R-etalon forms one reflector of the laser cavity.

[c13] The laser cavity of the claim 11 wherein the R-etalon is set that its peak wavelengths match to the ITU wavelengths within the required tolerance of accuracy and its FSR is set to the WDM channel spacing, such as 200GHz, 100GHz, 50GHz.

[c14] The laser cavity of the claim 11 wherein the extended gain chip has a gain section, a phase section and a reflective grating section on it.

[c15] The extended gain chip of the claim 14 wherein the reflective grating comprises one of sampled grating, super structure grating and digital grating, which exhibits a comb-shaped reflection spectrum.

[c16] The extended gain chip of the claim 14 wherein the grating forms another reflector of the laser cavity.

[c17] The extended gain chip of the claim 14 wherein the FSR of the

grating is slightly different from the multiple FSR of the R-etalon.

[c18] The extended gain chip of the claim 14 wherein the reflection peaks of the grating can be shifted by injecting current in the grating section.

[c19] The extended gain chip of the claim 14 wherein the phase section shifts the wavelengths of the cavity modes by injecting current in.

[c20] The laser cavity of the claim 11 wherein the R-etalon has an end mirror reflector comprising one of band-pass filter, low-pass filter, high-pass filter, and special filter to compensate the gain curve of the gain section.

[c21] A frequency tunable laser cavity comprising:
a gain chip generating substantially polarized light;
two R-etalons;
a cavity phase compensator;
wherein, because the light from the gain chip is substantially linearly polarized, only one of the two first linear polarizers in the two R-etalons necessary.

[c22] The laser cavity of the claim 21 wherein the two R-etalons form two end reflectors of the laser cavity.

[c23] The laser cavity of the claim 21 wherein one R-etalon (defined

as the first R-etalon) is set that its peak wavelengths match to the ITU wavelengths within the required tolerance of accuracy and its FSR is set to the WDM channel spacing, such as 200GHz, 100GHz, 50GHz.

[c24] The laser cavity of the claim 21 wherein the FSR of another R-etalon (the second one) is slightly different from the multiple FSR of the first R-etalon.

[c25] The laser cavity of the claim 21 wherein the FSR of the second R-etalon is tunable.

[c26] The laser cavity of the claim 21 wherein the phase compensator is a slab of transparent material with two anti-reflection coated parallel facet.

[c27] The phase compensator of the claim 26 wherein the slab can changes its thickness or refractive index or both thermally or electrically.

[c28] The laser cavity of the claim 21 wherein the phase compensator is a section of waveguide integrated on the gain chip.

[c29] The phase compensator of the claim 28 wherein the waveguide changes its optical refractive index by injecting current in it.

[c30] The laser cavity of the claim 21 wherein at least one of the two

R-etalons has an end mirror reflector comprising one of band-pass filter, low pass filter, high-pass filter, special filter to compensate the gain curve of the gain chip.

[c31] A R-etalon comprising:
two polarization rotators;
one linear polarizers;
two reflector; and
one cavity compensator;
the components arranged in the sequence: the linear polarizer, the first polarization rotator, the first reflector, the second polarization rotator (or the cavity compensator), the cavity compensator (or the second polarization rotator), the second reflector;
Wherein the cavity compensator and the second polarization rotator determine the FSR of the R-etalon.

[c32] The R-etalon of claim 31 wherein the two polarization rotators are Faraday rotator.

[c33] The polarization rotator of claim 32 wherein the Faraday rotator can rotate the polarization 45degree.

[c34] The R-etalon of claim 31 wherein the two polarization rotators are quarter waveplate.

[c35] The two polarization rotators of claim 34 wherein the optical axes of the quarter waveplates are set 45degree against the

polarization axis of the polarizer.

[c36]